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*The Equilibrium of Tortugas Sea Water with Calcite and Aragonite:* J. F. McClen-don, Department of Physiology, University of Minnesota and Tortugas Laboratory, Carnegie Institution of Washington. The surface water of the sea is the supersaturated solution of  $\text{CaCO}_3$  and it is only necessary to introduce calcite crystals in order to cause precipitation of this substance.

*An Oenothera-Like Case in Drosophila:* Herman J. Muller, The Rice Institute, Hous-ton. Report of an extended series of exper-iments showing that it will not do to accept evidence apparently in favor of factor incon-stantcy without the support of highly rigorous factorial analysis.

*Is Death from High Temperature due to the Accumulation of Acid in the Tissues?* Al-fred Goldsborough Mayer, Department of Ma-rine Biology, Carnegie Institution of Wash-ington. Death is probably due rather to the formation of acid than to coagulation of pro-teid substances.

*National Research Council:* Meetings of the Executive Committee.

EDWIN BIDWELL WILSON

MASS. INST. OF TECHNOLOGY

#### SPECIAL ARTICLES

##### THE DETERMINATION OF ATOMIC WEIGHTS BY MEANS OF X-RAYS

It does not seem to be generally realized that the recent developments in the study of crystal structure by the use of X-rays afford a method of determining atomic weights which may be of considerable value.

From the spectra obtained by exposing crys-tals of two different substances to X-rays of the same wave-length, the ratio of the dis-tances between adjacent layers of atoms in the two substances can be easily determined, as is well known. If the relative distances are de-termined in the direction of each crystal axis, these results, together with the inclination of the axes to each other in each crystal, enable one to calculate the ratio of the volumes of the elementary parallelopipeds of each crystal. From this ratio and the ratio of the densities we can easily calculate the ratio of the molec-

ular weights. From the ratios of molecular weights, atomic weights can be calculated in the usual manner.

This method requires the preparation of elements or compounds in a state of purity; the production of crystals of practically per-fect internal structure, though not necessarily with perfect faces, or of large size; and the measurement of densities and spectral angles and, except when the crystal axes are mutually perpendicular, the measurement of the angles between axes. All of these measurements can be made with considerable accuracy.

Most of the measurements of the angles of X-ray spectra that have been made hitherto have not been highly accurate, for such meas-urements have been used principally for the determination of the relative positions of atoms in crystals, and for this purpose great accuracy is not required. It appears, how-ever, that sufficient accuracy might be ob-tained to permit the determination of atomic weights with greater accuracy than that of most of the chemical determinations, and perhaps such accuracy has been obtained with recent spectrometric apparatus.

We are accustomed to think of the density of a substance as being a rather variable quality, but very few density measurements have been made upon perfectly pure material in the form of crystals of perfect internal structure. Very many materials, including metals, are handled commonly in the form of masses composed of a great number of small crystals, which, even if they consist of pure material, are likely to be very much distorted, and at the surface between two crystals there must be a layer of atoms many atoms deep which are not located exactly according to the space lattice of either crystal. There ap-pears to be no reason why the density of a flawless crystal of pure material should not be quite definite, except that the surface forces might cause a difference in density near the surface, as the result of which the mean density might depend somewhat upon the size of the crystal.

After suitable apparatus had once been set up this method should permit the determina-

tion of the atomic weights of a considerable number of elements with less consumption of time and in most cases with greater accuracy than the chemical methods that have been used hitherto.

C. W. KANOLT

BUREAU OF STANDARDS,  
WASHINGTON, D. C.

## THE MATHEMATICAL ASSOCIATION OF AMERICA

THE third annual meeting of the Mathematical Association of America was held at the University of Chicago on Thursday and Friday, December 27-28, 1917, in conjunction with the Chicago Section of the American Mathematical Society. There were 119 in attendance at this meeting, including 93 members and one institutional representative. The program is given herewith:

### PROGRAM

#### Thursday

*The graph of  $f(x)$  in line-coordinates for complex numbers*, PROFESSOR A. F. FRUMVELLER, Marquette University.

*On the generalization of the witch and the cisoid*, PROFESSOR F. H. HODGE, Franklin College.

*Fermat's method of infinite descent*, PROFESSOR W. H. BUSSEY, University of Minnesota.

*On the disciplinary and applied values of mathematical study*, PROFESSOR C. N. MOORE, University of Cincinnati.

*On the content of a second course in calculus*, PROFESSOR E. J. MOULTON, Northwestern University.

Address: *Descriptive geometry and its merits as a collegiate as well as an engineering subject*, PROFESSOR W. H. ROEVER, Washington University.

Brief discussions by Professor F. Higbee, department of descriptive geometry and drawing, State University of Iowa; Professor A. V. Millar, department of drawing, University of Wisconsin; Professor Arnold Emch, department of mathematics, University of Illinois; Mr. Willard W. Erme-ling, instructor in descriptive geometry, Crane Junior College, Chicago; Mr. W. F. Willard, instructor in drawing, Carl Schurz High School, Chicago. General discussion.

#### Friday

Report of standing committees.

Committee on Mathematical Requirements.

*Scientific investigations of the committee*, PROFESSOR A. R. CRATHORNE, University of Illinois.

*The work of a committee representing the Central Association of Science and Mathematics Teachers*, MR. J. A. FOBERG, Crane Junior College, Chicago.

Committee on Libraries.

A report of this committee was published in the October *Monthly*.

Discussion opened by Professor H. E. Slaughter, University of Chicago.

Committee on Mathematical Dictionary.

Preliminary report by the chairman, Professor E. R. Hedrick, University of Missouri.

Committee on *Annals of Mathematics*. Report by Professor E. H. Moore, University of Chicago.

Committee on Bureau of Information. Report by Professor J. B. Shaw, University of Illinois.

Joint session of the Mathematical Association of America and the American Mathematical Society.

Retiring address of the chairman of the Chicago Section of the Society: *A conspectus of the modern theory of divergent series*, by PROFESSOR W. B. FORD, University of Michigan.

Address on behalf of the association: *On a definition of the real number system by means of infinite decimals*, by PROFESSOR L. D. AMES, University of Missouri.

Seventy-three attended the joint dinner of the society and the association at the Quadrangle Club on Thursday evening, and a good number of the members attended the dinner of the American Association of University Professors on Friday evening.

At the annual business meeting amendments were adopted according to which the office of managing editor is divided into those of editor and manager, and the office of secretary-treasurer is to be filled through appointment by the council rather than through election by the association. Twenty-four persons and three institutions were elected to membership. The report of the secretary-treasurer showed that the association is appropriating a substantial subvention to the *Annals of Mathematics* in return for the addition to each volume of this journal of one hundred pages or more of articles of an expository or historical nature; that one hundred dollars has been set aside to cover some necessary expense in the work of the National Committee on Mathematical Requirements; that the year's business shows a gain of approximately one hundred dollars.

The following are the officers for 1918:

E. V. HUNTINGTON, Harvard University, President.

D. N. LEHMER, University of California; J. W. YOUNG, Dartmouth College, Vice-presidents.

W. D. CAIRNS, Oberlin College, Secretary-Treasurer.

Committee on Publications: W. H. BUSSEY, University of Minnesota; R. D. CARMICHAEL, University of Illinois, editor; H. E. SLAUGHT, University of Chicago, manager.

Members of the council (for three years): FLORIAN CAJORI, Colorado College; ELIZABETH B. COWLEY, Vassar College; G. A. MILLER, University of Illinois; E. T. WILCOZYNSKI, University of Chicago.

W. D. CAIRNS,  
Secretary-Treasurer